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EXAMINER	
NGUYEN, STEVEN H D	
ART UNIT	**PAPER NUMBER**
2616	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	01/03/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No. 09/805,887	Applicant(s) LAROIA ET AL.	
	Examiner Steven HD Nguyen	Art Unit 2616	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 October 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-74* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-74* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *10/18/06*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 10/4/06 has been entered.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1, 4-5, 12, 16-28, 20-22, 25, 29-33, 40-41, 53, 65, 67, 69-70 and 74 are rejected under 35 U.S.C. 103(a) as being unpatentable over Frenkel (USP 5838268) in view of Shattil (WO 99/41871).

Regarding claims 1, 17, 25, 29, 30 and 41, Frenkel discloses a communication system for generating an OFDM signal having frequency tones distributed over a predetermined bandwidth, the communication system comprising a mapping circuit (Fig 1, Ref 20) that receives data symbols from a symbol constellation and maps the symbols to prescribed time instants in a time domain symbol duration to generate a discrete signal of mapped symbols; an interpolation circuit (Fig 1, Ref 30 for combining the phase shift carriers to produce one or more information

modulated pulses centered at the predetermined instants in time wherein the pulses are distributed throughout each data symbol interval) receives the discrete signal and generates a continuous signal by applying an interpolation function to the discrete signal, the interpolation function operating on the discrete signal (See col. 10, lines 15 to col. 12, lines 18). However, Frenkel fails to fully disclose a frequency response of the continuous signal includes sinusoids having non-zero values at a first set of tones, the first set of tones being a subset of said multiple tones, the non-zero value at each of said first set of tones being a function of a plurality of mapped symbols corresponding to different discrete points in time, the frequency response of the continuous signal also including zero values at a second set of tones, the second set of tones being different from said first set of tones and being another subset of said multiple tones. In the same field of endeavor, Shattil discloses frequency response of the continuous signal includes sinusoids having non-zero values at a first set of tones, the first set of tones being a subset of said multiple tones, the non-zero value at each of said first set of tones being a function of a plurality of mapped symbols corresponding to different discrete points in time, the frequency response of the continuous signal also including zero values at a second set of tones, the second set of tones being different from said first set of tones and being another subset of said multiple tones (Fig Ref 20 functions as an interpolation circuit because it combines the phase shifted carriers to produce one or more information-modulated pulses centered at the predetermined instants in time. Multiple pulses may be distributed throughout each data symbol interval. The frequency response of the pulses includes sinusoids).

Since, Shattil suggests the transmitter can be implemented in OFDM system. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention was made

to apply a method and system includes a frequency response includes sinusoids having non zero values for first set carrier and zero values for second set carrier as stated by Shattil into the method and system of Frenkel. The motivation would have been to reduce interference.

Regarding claims 50 and 67, Frenkel discloses a OFDM system for receiving as input data symbols to be transmitted by the OFDM communication signal (Fig 1, Ref 10); mapping the data symbols to the equally spaced time instants in the symbol duration to generate a discrete signal of mapped symbols (Fig 1, Ref 20); generating a continuous signal by applying an interpolation function to the discrete signal (Fig 1, Ref 30). However, Frenkel fails to disclose the interpolation function operating on the discrete signal such that a frequency response of the continuous signal includes sinusoids having non-zero values at the allocated frequency tones, and zero values at frequency tones other than the allocated frequency tones; and sampling the continuous signal at discrete time instants distributed over the time domain symbol duration, to generate a digital signal sample vector and providing a time domain symbol duration having equally spaced time instants; allocating a predetermined number of frequency tones to the communication device. In the same field of endeavor, Shattil discloses the interpolation function operating on the discrete signal such that a frequency response of the continuous signal includes sinusoids having non-zero values at the allocated frequency tones, and zero values at frequency tones other than the allocated frequency tones (Fig 1, ref 20); allocating a predetermined number of frequency tones to the communication device (Page 7, lines 24-29 and page 12, lines 3-8); providing a time domain symbol duration having equally spaced time instants (Page 7, lines 24-29 and Page 6, line 4-11). However, Frenkel and Shattil fail to disclose sampling the continuous signal at discrete time instants distributed over the time domain symbol

duration, to generate a digital signal sample vector. However, a sampling circuit is well known and expected in the art. Therefore, it would have been obvious to one of ordinary skill in the art the time of invention was made to implement a sampling circuit for sampling the signal into he teaching of Shattil which includes a frequency response includes sinusoids having non zero values for first set carrier and zero values for second set carrier into the method and system of Frenkel. The motivation would have been to reduce interference.

Regarding claim 4, 5, 20, 21, 53 and 69, Shattil discloses the frequency tones within the first set of tones are equally spaced frequency tones, and the prescribed time instants are equally spaced and uniformly distributed over a fraction of one symbol duration which is defined by 1/L where L is the spacing between two adjacent allocated frequency tones in the first set of tones (Fig 8, page 7, line 33 to page 8, line 7, equally spaced carrier frequencies distributed over a predetermined frequency band. Since the carriers in a set of non-adjacent carrier frequencies are separated by an integer multiple L of the adjacent carrier frequency separations fs, the frequency spacing f_s' in the set of non-adjacent carriers is: $f_s' = Us$. Thus, the effective symbol duration T' (i.e., pulse repetition period) of the non-adjacent carriers is a fraction 1/L of the symbol period $1/f_s$, such as described on page 5, lines 34-35, and represented by equation T' = Tb/L).

Regarding claim 12, 40 and 70, Frenkel discloses the data symbols are complex symbols associated with a symbol constellation (Fig 1, Ref 10).

Regarding claims 16, Frenkel discloses including a digital to analog converter operable to receive the digital signal sample vector and generate an analog signal for transmission (Fig 1, ref 50). However, Frenkel and Shattil fail to disclose a sampling circuit for sampling the continuous

signal to produce a digital sample vector. However, a sampling circuit is well known and expected in the art at the time of invention was made. therefore, it would have been of obvious to one of ordinary skill in the art at the time of invention was made to apply a sampling circuit for sampling a signal into the teaching of Frenkel and Shattil. The motivation would have been to reduce interference.

Regarding claims 18 and 32, Shattil discloses the allocated frequency tones are associated with a designated transmitter within the communication system to be used FDM (each user may be allocated a unique set of carriers (such as described on page 7, lines 27-29 and page 12, lines 3-8; FIG. 8 (page 7, lines 33 35; FIG. 12A show carrier frequencies allocated to a particular user).

Regarding claims 22, Shattil discloses the allocated frequency tones are contiguous frequency tones, and the prescribed time instants are equally spaced time instants uniformly distributed over one symbol duration (a plurality of carriers provided with phase offsets to produce pulse waveforms centered at predetermined time instants (page 2, lines 32-36, page 5, lines 1-4, page 5, line 28 to page 6, line 27, and page 7, lines 27-32, and shown in Figs. 4, 5B, and 12B; The carriers are modulated with data symbols on page 4, lines 25-28; such that each data symbol is mapped to a pulse centered at a predetermined instant in time. Thus the values of the data-modulated pulses at the pulse peak (i.e., time instances at which the pulses are centered) equal the value of the data symbol corresponding to the pulse position).

Regarding claim 33, Frenkel disclose a transmitter (Fig 1).

Regarding claim 65, Frenkel discloses raise cosine (Fig 6, Ref 360).

4. Claims 2-3, 6, 19, 38-39, 51-52, 64 and 68 are rejected under 35 U.S.C. 103(a) as being unpatentable over Frenkel and Shattil as applied to claims 1, 17, 30, 50 and 67 above, and further in view of Nasar (IEEE).

Regarding claim 2, 39 and 51, Frenkel and Shattil fail to disclose the discrete time instants are defined within the range of 0, T/N, 2T/N, . . . , T (N-1)/N, where N is a total number of time instants in the predetermine time interval. In the same field of endeavor, Nassar describes the spacing of the pulse positions (i.e., time instants) corresponding to zeroes in the cross-correlation function (shown in equation 5 and described on page 2, column l, line 36 to page 2, column 2, line 26). The pulses are centered at equally spaced instants: k/N delta f where k = 0, 2 ,..., N-1, N is the number of carriers, and delta f = 1/Tb is the frequency separation between the carriers. Thus, the time instants are defined by 0, Tb/N, 2Tb/N,..., Tb(N-1)/N.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention was made to define the range of discrete time instance as disclosed by Nassar into the system and method of Frenkel and Shattil. The motivation would have been to obtain a quality signal by reducing the noise.

Regarding claim 3, 19, 52 and 68, Frenkel fails to disclose the claimed invention. Shattil01 discloses the frequency tones within the first set of tones are contiguous frequency tones (Fig 5, Page 4, lines 28-34). However, Frenkel and Shattil fail to disclose the prescribed time instants are equally spaced and uniformly distributed over one symbol duration. In the same field of endeavor, Nassar discloses the prescribed time instants are equally spaced and uniformly distributed over one symbol duration (Page 2, Sec 2, a plurality of pulses equal to the number of

carriers can be positioned orthogonally at uniformly spaced instances in each symbol duration. A symbol duration Tb equals the inverse of the frequency spacing delta f between the carriers. The time instants are spaced apart at intervals of Tb/N).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention was made to apply prescribed time instants are equally spaced and uniformly distributed over one symbol duration as disclosed by Nassar into the system and method of Frenkel and Shattil. The motivation would have been to obtain a quality signal by reducing the noise.

Regarding claims 6 and 64, Nassar discloses a total number of discrete time instants is greater than or equal to a total number of frequency tones distributed over the predetermined bandwidth (Page 1, Right col. Line 33 to page 2, left col. 3; a multicarrier systems in which a number of users (i.e., pulse positions) may be greater than the number of carriers).

Regarding claim 38, Frenkel and Shattil fail to disclose a sampling circuit that samples the continuous signal at discrete time instants distributed over the time domain symbol duration to generate a digital signal sample vector. However, the use of sampling circuit is well known and expected in the art at the time of invention was made to apply a sampling circuit into the teaching of Frenkel and Shattil in order to sampling a signal into a digital signal. The motivation would have been to reduce interference.

5. Claims 7, 23, 26, 34, 42 and 66 are rejected under 35 U.S.C. 103(a) as being unpatentable over Frenkel and Shattil as applied to claims 1, 30 and 50 above, and further in view of Petit (USP 5491727).

Regarding claims 7, 23, 26, 34, 42 and 66, Frenkel and Shattil fail to disclose the interpolation circuit further includes a memory for storing the predetermined interpolation functions, and an interpolation function module for retrieving the interpolation functions from the memory and applying the interpolation functions to the discrete signal to generate the continuous signal. In the same field of endeavor, Petit discloses a lookup table of sine values and tables of envelop functions stored in memory and used to generate signals for transmission in multi tomes system (See col. 6, lines 50-67).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to apply the tables for using to generate multi-tones signal as disclosed by Petit into the system of Frenkel and Shattil. The motivation would have been to obtain a quality signal by reducing the noise.

6. Claims 8-11, 13-15, 24, 27-28, 35-37, 42-43, 54-63 and 71-73 are rejected under 35 U.S.C. 103(a) as being unpatentable over Frenkel, Petit and Shattil as applied to claims 1, 25, 30, 41 and 50 above, and further in view of Nasar (IEEE).

Regarding claim 8, 27, 28, 36, 37, 43 and 44, Frenkel, Shattil and Petit fail to disclose the interpolation functions comprise a matrix of precomputed sinusoidal waveforms. However, Nassar discloses the interpolation functions comprise a matrix of precomputed sinusoidal waveforms (Page 3, equation 6 and 7 discloses a matrix of sinusoids).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to apply a matrix of precomputed sinusoidal as disclosed by Petit into the system of Frenkel, Petit and Shattil. The motivation would have been to obtain a quality signal by reducing the noise.

Regarding claims 9 and 16, Frenkel discloses the interpolation functions comprise continuous interpolation functions (Fig 1, Ref 30).

Regarding claims 10, 11, 24, 35, 54 and 55, Frenkel and Shattil fail to disclose the mapping circuit replicates the discrete signal of mapped symbols to generate an infinite series of mapped symbols over prescribed time instants covering a time interval from minus infinite to plus infinite and the interpolation functions comprise sinc interpolation functions, and the interpolation circuit applies the sinc interpolation functions to the infinite series of mapped symbols. However, the generation of a continuous function via interpolating a series of symbols with a sinc function is well known and expected in the art at the time of invention was made. Therefore, it would have been obvious to one of ordinary skill in the art to implement mapping circuit replicates the discrete signal of mapped symbols to generate an infinite series of mapped symbols over prescribed time instants covering a time interval from minus infinite to plus infinite into the teaching of Frenkel and Shattil. The motivation would have been to obtain a quality signal by reducing the noise.

Regarding claim 13, Frenkel and Shattil fail to disclose including a digital signal processor for implementing the mapping circuit and the interpolation circuit. However, Frenkel suggest DSP to be use for implement mapping circuit. Therefore, it would have been obvious to one of ordinary skill in the art to implement both circuit into DSP of Frenkel and Shattil. The motivation would have been to reduce the cost of the system.

Regarding claims 14, 15, 62 and 63, Frenkel and Shattil fail to disclose a sampling circuit for sampling the continuous signal to produce a digital sample vector and cyclic prefix. However, a sampling circuit for sampling the continuous signal to produce a digital sample

vector and the cyclic prefix is well known and expected in the OFDM art. Therefore, it would have been obvious to one of ordinary skill in the art to implement a circuit for adding the cyclic prefix in the OFDM signal of Frenkel. The motivation would have been to prevent interference.

Regarding claims 56-61 and 71-73, Frenkel and Shattil fail to disclose the claimed invention. However, it is well known in the art at the time of invention was made to provide a phase offset equal to pi/4 by using offset QPSK such delaying an odd with even bit stream; mapping complex symbols to equally space time instant. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention was made to implement a phase offset by pi/4 using offset QPSK into the system of Frenkel and Shattil. The motivation would have been to obtain a quality signal by reducing noise.

Response to Arguments

7. Applicant's arguments filed 10/04/06 have been fully considered but they are not persuasive.

In response to pages 19-27, the applicant states that Shattil does not disclose an interpolator. In replies, Shattil discloses Fig 1, Ref 20 performs the functions of the claimed interpolator as set forth in the office action, section 2. Furthermore, the applicant states that the examiner indicated Fig 1, ref 20 of Shattil as a mapping function of the claims 50 and 67. In reply, the examiner does not indicate Ref 20 of Shattil as a mapping function. The examiner indicated Ref 20 of Shattil as an interpolator and Ref 20 of Frenkel as a mapping function.
In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the

teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, Frenkel discloses the limitation of the claimed excepting for function of interpolator. However, Shattil discloses a combiner circuit, which is function as the claimed interpolator. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention was made to apply the teaching of Shattil into the teaching of Shattil. The motivation would have been to reduce side lobe activity in the time domain in order to support additional users with reduced interference, flexibility of user position in time allows for positions that optimize various criteria such as minimizing near-far effects, optimizing performance for a given combining/multi-user detection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Steven HD Nguyen whose telephone number is (571) 272-3159. The examiner can normally be reached on 8:00-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wellington Chin can be reached on (571) 272-3134. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Steven HD Nguyen
Primary Examiner
Art Unit 2616